1. a) $P(1) = 7.8e^r = 1.01(7.8) \Rightarrow e^r = 1.01 \Rightarrow r = \ln(1.01)$

≈ 0.00995

$P(t) = 7.8e^{\ln(1.01)t} = 7.8(1.01)^t$

b) $P(10) = 7.8(1.01)^{10} \approx 8.62$ billion

$P(100) = 7.8(1.01)^{100} \approx 21.10$ billion

c) $\lim_{t\to\infty} P(t) = \infty$. Not very realistic.

d) $b = d$ is the only situation in which pop is steady.

Conclusion: use birth control or plan to settle other planets (or have d increase a lot).

2. a) $T = 5 + 30e^{-kt}$

$T(1/2) = 5 + 30e^{-k/2} = 25$

$e^{-k/2} = \frac{20}{30} = \frac{2}{3}$

$-\frac{k}{2} = \ln(2/3) \Rightarrow k = -2\ln(2/3)$

$T = 5 + 30e^{2\ln(2/3)t} = 5 + 30\left(\frac{2}{3}\right)^{2t} = 5 + 30\left(\frac{4}{9}\right)^t$

b) $95 = 5 + 30\left(\frac{4}{9}\right)^t \Rightarrow \left(\frac{4}{9}\right)^t = \frac{90}{30} = 3 \Rightarrow t = \frac{\ln(3)}{\ln(4/9)} \approx -1.355$ hr

or about 81 minutes before 12:15, ie 10:54